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THEATER ARMY COMMAND AND CONTROL SYSTEM: AN EVALUATION OF THE REQUIREMENT AND PROPOSED SOLUTION

BY

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USAWC MILITARY STUDIES PROGRAM PAPER

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AN INDIVIDUAL STUDY PROJECT

by

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ABSTRACT

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INTRODUCTION

"Generally, management of many is the same as management of few. It is a matter of organization. And to control many is the same as to control few. This is a matter of formations and signals."

Sun Tzu
The Art of War[1]

In this quote, Sun Tzu indicates that controlling a large number of people takes organization, formations, and signals. A Commander must have a structured framework in which to operate (organization), procedures or methods by which the organization is controlled (formations), and the means to convey his instructions in a timely and accurate manner (signals). In order to be effective, these three factors must be integrated into a cohesive system--a tool which a Commander may use in exercising command and control over his unit--a command and control (C2) system. This system for command and control may be very simple, or it may be highly complex. As the size of an organization increases, the size and complexity of the system through which the Commander exercises command and control by natural cause must also increase (even though that system still consists basically of organization, formations, and signals). For small units, the leader keeps most of the

information he requires in a pocket-size notebook; his unit's size, organization, and functions are, for the most part, pre-defined for him; and his control is accomplished through voice commands and hand/arm signals. As units grow in size, the amounts of information required are such that large files or automatic data processing equipment are required for information storage and retrieval; the organization, size, and functions of the unit may vary, depending upon assigned missions; and communication may require extensive networks which carry combinations of voice and data traffic.

A key factor in controlling an organization is timely, accurate, and pertinent information. Obtaining this information may mean sorting through tremendous amounts of information in order to pick out that which is necessary to the successful execution of the operation in progress (or that which, if ignored or not known, could mean disaster for the operation). As Martin Van Creveld wrote in his book, Command in War, "The history of command can thus be understood in terms of a race between the demand for information and the ability of command systems to meet it."[2] In today's world (especially for a Theater Army Commander), meeting this demand for information means the use of a secure, sophisticated communications network utilizing multiple carrier technologies (including satellite,

terrestrial radio links, fiber optics, and land line). It means an automated data processing (ADP) system (or a combination of ADP systems with multiple data bases), linked into the secure communications network. Finally, it means procedures, personnel, and facilities from which to operate. A system which combines these elements to facilitate the command and control of a complex organization is referred to as a command and control (C2) system. Ideally, a C2 system will assist in the accomplishment of the four C2 processes: planning, coordinating, directing, and controlling.[3]

Command and Control System Defined

Joint Pub 1-02, Department of Defense Dictionary of Military and Associated Terms, defines a Command and Control System as follows:

> **"The facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned."[4]**

U.S. military forces utilize command and control (C2) systems at the strategic, operational, and tactical levels. A example of a strategic-level C2 system is the Worldwide Military Command and Control System (WWMCCS); it supports the National Command Authority (NCA), the Joint Chiefs of

Staff (JCS), the Commanders-in-Chief (CINCs) of the Unified and Specified Commands, and selected Major Commands. An example of a tactical-level C2 system is the Army Tactical Command and Control System (ATCCS); it supports echelons corps and below (ECB). An operational-level C2 system is one which supports a Theater Army (TA), or the Army Component Command (ACC) of a Unified or Specified Command; it falls between the strategic and tactical C2 systems (see Figure 1).

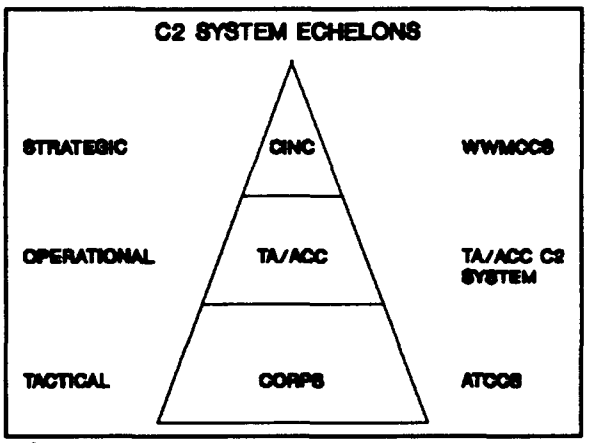

Figure 1. C2 System Echelons.

Theater Army/Army Component Command

A Theater Army/Army Component Command (TA/ACC) is a complex organization. It is composed of a large number of people in numerous types of organizations. FM 100-16: Support Operations: Echelons Above Corps lists the following key functions of a Theater Army:[5]

- Provide command and control (C2) of assigned and attached U.S. Army units.
- Provide echelons above corps (EAC) intelligence support to the corps.

- Provide nonorganic communications support within the Communications Zone (COMMZ).
- Receive, equip, and assist in preparing U.S. Army units for combat.
- Provide support to U.S. Army units, other U.S. Services as required, and selected allied forces in theater.
- Provide personnel service support to all TA personnel.
- Conserve TA trained manpower by providing health service support.
- Provide construction and engineer support to TA organizations.
- Provide rear area security in the COMMZ.
- Evacuate U.S. national civilian non-combatants.
- Provide custody, control, internment, and disposition of prisoners of war.

These activities must be accomplished to some degree regardless of where the TA/ACC is located, or how long it has been there. In addition, current doctrine states that if the Commander-in-Chief (CINC) of the Unified/Specified Command having combatant command (COCOM) of the TA so desires, the TA may also be responsible for the operational employment of subordinate combat units (including Numbered Army headquarters, and echelons Corps and below (ECB)).[6]

This is a significant departure from past doctrine, which held that the Theater Army was primarily an administrative/logistics organization, and that tactical employment of combat forces was the responsibility of the Corps (or Numbered (Field) Army headquarters), reporting directly to the CINC on operational matters. This change in doctrine gives the CINC the option of maintaining direct control of the employment of Army combat forces, or of making his Army Component Commander responsible for their employment. This has significant ramifications for the C2 system supporting the TA/ACC. The C2 system of a headquarters with a primarily administrative/logistical orientation will have different mobility and information requirements than the C2 system of a headquarters having operational responsibilities. In the case of the TA/ACC, these operational responsibilities will either be <u>in addition to</u> its administrative/logistical responsibilities, or an operations cell will be taken out of the TA for the purpose of controlling subordinate tactical organizations. This would leave the TA responsible only for administrative/logistical matters, but a portion of its C2 system may have to be dedicated to the support of this operations cell.

It is reasonable to assume that the C2 system which supports the common activities listed above would be

standardized throughout the Army. Unfortunately, that is not the case. There are currently four deployed Theater Army or Army Component Command Headquarters:

- Eighth U.S. Army in South Korea
- Army Forces U.S. Southern Command in Panama
- U.S. Army Europe/Seventh U.S. Army
- U.S. Army Japan

In addition, there is one deployable TA/ACC Headquarters (Third U.S. Army/Army Forces Central Command) located in the Continental U.S. (CONUS).

At the present time, each of these organizations has a command-unique C2 system to support its operations. These "systems" range from an extensive combination of a wide area network (WAN) and multiple local area networks (LAN) at U.S. Army Europe, to the proverbial "stubby pencil" at U.S. Army Japan. The Army has recognized that this is an inefficient and potentially ineffective way to operate, and is taking steps to rectify the problem by developing a standardized C2 system for TA/ACC. The system is called the Standard Theater Army Command and Control System (STACCS).[7] It will provide a uniform approach to the accomplishment of many TA/ACC C2 functions; it will also ease training requirements for individuals or units which move from one TA/ACC to another.

The organization of the TA/ACC is flexible and varies from Theater to Theater--however, in all cases it is organized to maximize Army capabilities. This organization takes into account three roles for the conduct of Army operations in a joint environment: joint coordination, conduct of operations, and support of operations.[8] The Army's contribution to the Theater may include combat, combat support (CS), and combat service support (CSS) units. The combat units may include Corps and (if present) Numbered Armies. The support organizations are subdivided according to their orientation (area oriented and mission oriented). Area oriented organizations include the Theater Army Area Command(s) (TAACOM) and the TAACOM's subordinate Area Support Group(s) (ASG). Mission oriented organizations are those with functional responsibilities, such as transportation commands.[9]

Theater Zones

The Theater is organized into two major zones: the combat zone, and the communications zone (COMMZ). The combat zone begins at the Numbered Army/Corps rear boundary and

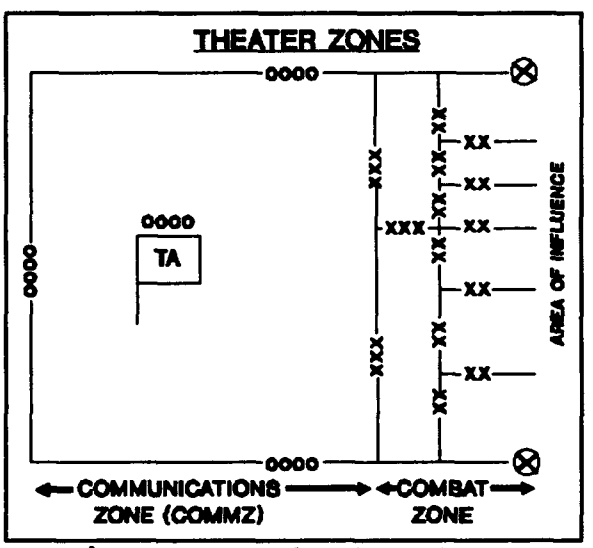

Figure 2. Theater Zones

extends forward to the extent of the commander's area of influence. The COMMZ begins at the Numbered Army/Corps rear boundary and extends rearward to include the area needed to provide support to forces in the combat zone.[10] Figure 2, graphically portrays these zones. The sizes of the combat zone and COMMZ depend on the Unified Command's area of responsibility (AOR). A large Theater can have Combat Zone(s) and a COMMZ which encompasses an area which is thousands of square miles. (In fact, given the current state of worldwide satellite communications capability which exists today, some would argue that the COMMZ may actually reach from the Theater back to the Continental United States (CONUS)). It is primarily in the COMMZ (whatever its physical limits) that the TA/ACC C2 system is employed.

The TA/ACC is organized within these two primary zones to support deployed U.S. Army forces (as well as the forces of other U.S. Services and allies, if required). This support includes the receipt and processing of all classes of supply, equipment, personnel, and units. It also includes organizing the AOR to facilitate the sustainment of forces deployed there. This encompasses the operation of a transportation system, assembly areas, supply dumps, maintenance facilities, POL and ammunition storage and distribution facilities, medical facilities, and the lines

of communication which connect these entities with each other and with the combat units supported by them.

THE REQUIREMENT

The TA/ACC C2 system must provide the wherewithal to collect and process the tremendous amounts of information pertaining to Army operations in the Theater of War, and present this information to the TA/ACC chain of command and staff in a manner which is useful. It must be a tool which assists in mission accomplishment throughout the continuum of operations (from daily peacetime activities, through transition to war, to war itself). The following paragraphs provide specific requirements for the TA/ACC C2 system.

Capture, Processing, and Presentation of Critical Data.

A generic Theater Army[11] is shown in Figure 3. It is a complex grouping of many different types of organizations which have a requirement to exchange large amounts of information on a real time (or near-real time) basis. This information includes such things as data on supply stockage levels, transportation availability and utilization, unit status, personnel status, locations of units, supplies, and equipment, available supply rates, etc. The C2 system supporting the TA/ACC should be capable of the rapid

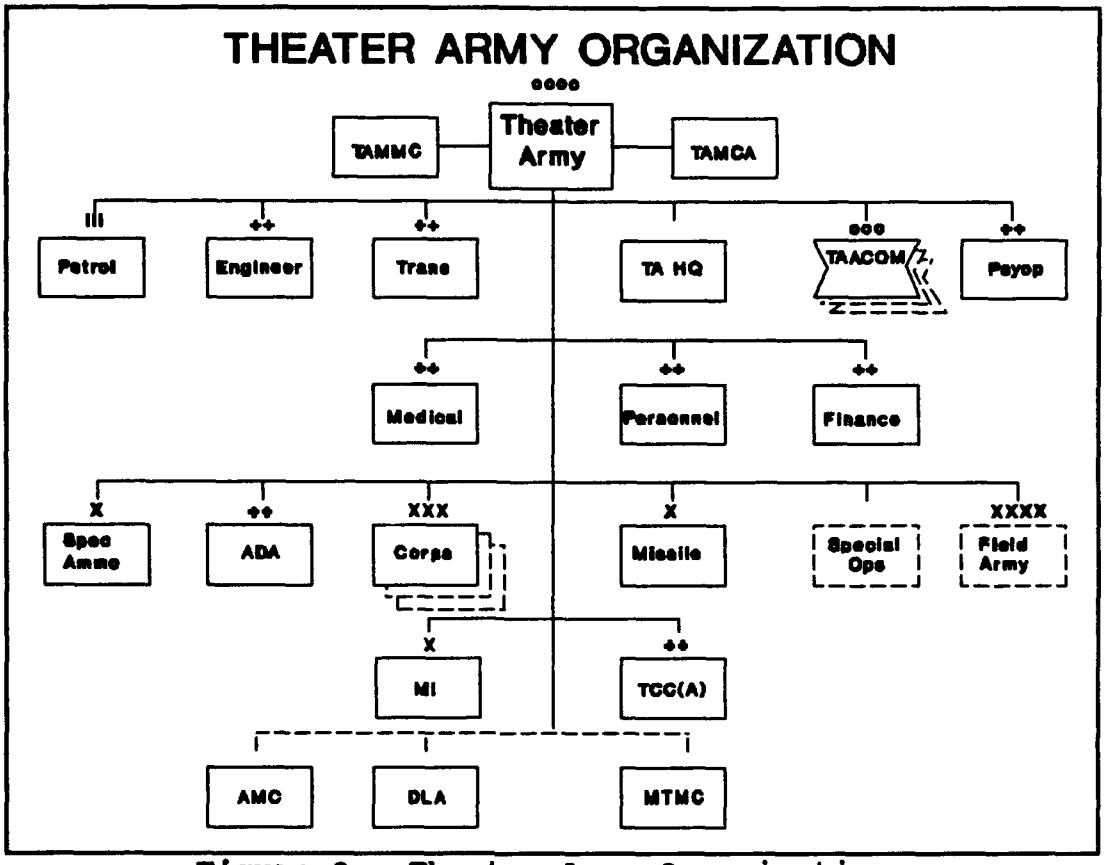

Figure 3. *Theater Army Organization.*

exchange of this information. It should also be capable of aggregating diverse categories of information, and of presenting this information in a form which is easily understandable to the commanders and staff officers by whom it is used. This includes not only report generation capabilities, but also briefing support systems and graphics capability. These capabilities require a sophisticated system for data management and for data base management.

Multiple Integrated Data Bases.

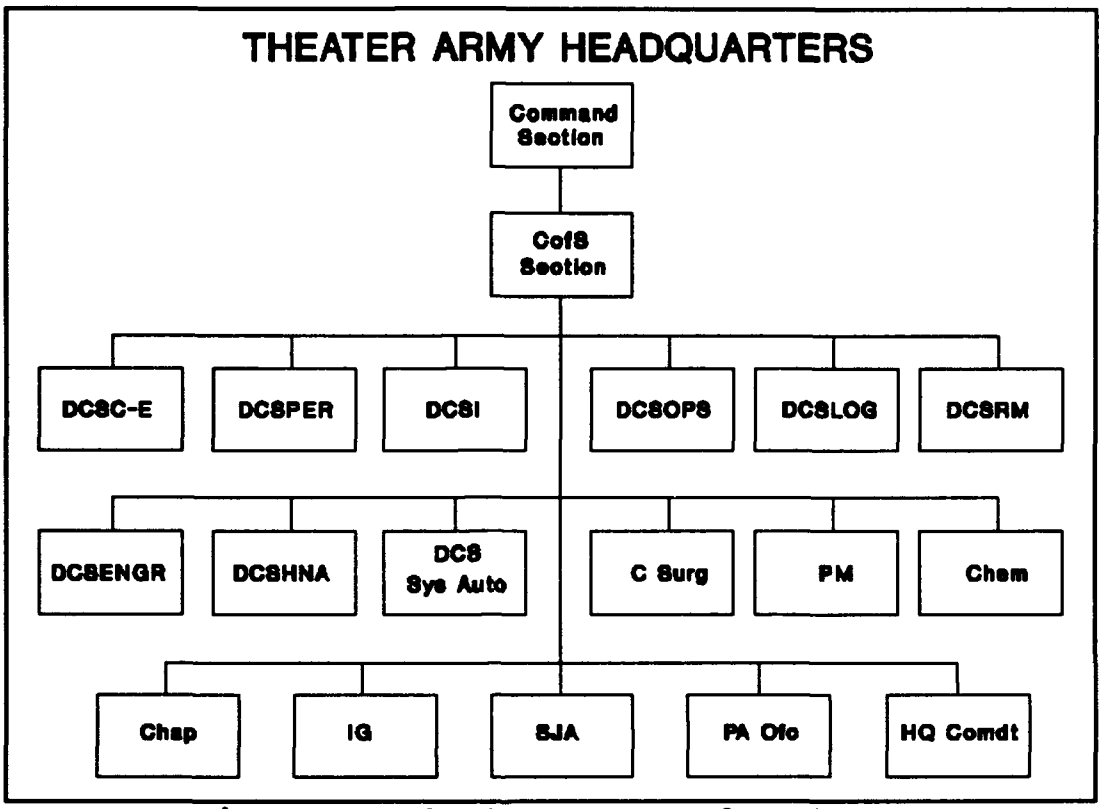

Figure 4. Theater Army Headquarters.

The headquarters which controls the TA/ACC is organized as shown in Figure 4.[12] Ideally, the C2 system supporting this headquarters should allow for the rapid exchange of information within and between staff offices. It should also facilitate information exchange with the subordinate organizations shown in Figure 3. This information includes various types of correspondence (orders, memoranda, reports), data file transfers, and the results of data base updates. The C2 system data base must be designed in a manner which will allow rapid visibility of data base

updates throughout the system. It must also be designed to allow "read only" data availability for all organizations having the need to know, and to restrict the ability to add, change, or delete the data to specifically authorized organizations or individuals. This authorization should be dependent upon the data element(s) being updated, and should be based on "best source" (or sources) for the data. (The "best source" for the data will depend upon the data itself, and will be determined by the data base administrator, in conjunction with the functional users of the data). The data base should be designed in echelons, so that the level of detail available is commensurate with the level of command needing it. Each of the subordinate commands should have its own data base. These data bases should "feed" the TA/ACC data base(s); i.e., the user should only have to enter an update transaction one time--it should then be automatically promulgated throughout the system. The TA/ACC data bases should contain data which is of interest to the entire TA/ACC; this includes maps, unit-related data, supply and transportation data, etc. Data base updates should occur either by directly submitted transactions from TA/ACC Headquarters staff, or by the automatic capture of specific information from the subordinate command data bases (as described above). These TA/ACC data bases should exist redundantly on several data base management system host

computers throughout the C2 system in order to ensure data availability in the event of a communications outage.

Security.

As Army units deploy into the Theater, they come under control of the TA/ACC until they are manned and equipped, and ready to start operations. When the units are ready for employment, they are placed under the operational command of the appropriate commander (as specified by the CINC). The C2 system supporting the TA/ACC should provide visibility of the units' progress from the port(s) of debarkation, to assembly areas, link-up with equipment, determination of combat readiness, and hand-off to the appropriate headquarters. During this process, the C2 system should be capable of sending orders and instructions to these units in their assembly areas, and of receiving status reports and requests for assistance from them. Because of the sensitivity of this operational data, the C2 system should be capable of processing information classified at up to and including SECRET.

Expandability & Flexibility.

The TA/ACC must be organized so that it may be expanded to provide additional support as more units deploy into the

Theater.[13] This means that the TA/ACC C2 system must also be expandable--and flexible. It also means that the C2 system must be capable of using almost any available communications means (including the public telephone system, the Defense Integrated Secure Network (DISNET), satellite, radio, tactical switch, etc.).

Mobility.

The TA/ACC C2 system should also be mobile. "Mobile" in this context means that the data communications system and the C2 system ADP hardware must be capable of being moved from place to place and set up rapidly. It must make maximum use of existing communications links, and allow the use of laptop computers with dial-up modems as one of the means of data entry and retrieval. This requirement is driven by the possibility that the TA/ACC may be moved to different locations within the Theater, or may also be deployed from one Theater to another (or from CONUS into the Theater).

Reliability.

The TA/ACC C2 system should be a network designed to facilitate the system-wide exchange of information (including raw data, electronic mail, correspondence, and

files). The network should consist of a primary and alternate network control node, communications nodes, sub-networks (local area networks--LAN), and individual terminal facilities. A recommended architecture for this system will be discussed in the section of this document dealing with the strawman TA/ACC C2 system.

Capability for Linkage with Other C2 Systems.

The TA/ACC C2 system should also link the TA/ACC Headquarters with external organizations and networks. The external organizations include higher and adjacent headquarters (the Unified Command and the other Component Commands), as well as certain organizations in CONUS (the rear detachment, Forces Command, depots, etc.). This linkage may be accomplished by liaison personnel using standard personal computer (PC) compatibles (or laptop computers) over any available communications media (DISNET, public switched telephones, etc.). The linkage may also be accomplished by providing the organizations with which the TA/ACC wishes to communicate with a workstation, data communications hardware, and the training to enable personnel from those organizations to enter the network.

In the context of the linkage with higher and adjacent headquarters, the TA/ACC C2 system should allow for the

generation of digital message traffic in all necessary formats (free-text format, command-unique format(s), or United States Message Text Format (USMTF)). The link into the DoD messaging system may either be automated (through an automated message handling system (AMHS)), or manual--generating a floppy disk which can be taken to the Command Message Center and entered into the AUTODIN. The TA/ACC C2 system should also be capable of using data imported from other C2 systems, including Time-Phased Force Deployment Data (TPFDD) down-loaded from the Worldwide Military Command and Control System (WWMCCS). (Note that, as of this writing, this down-load cannot not be automatically done due to the fact that WWMCCS is a TOP SECRET-high system, and the TA/ACC C2 system is SECRET-high; the data would have to be copied onto removable magnetic media, printed or displayed, and manually screened by a security officer prior to download). The TA/ACC C2 system should also interface with the Army Tactical Command and Control System (ATCCS), the tactical C2 system used by echelons corps and below (ECB).

Office Automation Capabilities.

In addition to functioning as a communications and data processing system, the TA/ACC C2 system should also provide office automation capabilities. The workstation which the staff officer uses to interface with the C2 system should

provide him or her with stand-alone word processing, graphics, spread sheet, data base, calendar, and calculator. The capability for local file transfer, E-mail, and electronic message coordination should also be part of the system.

User Friendly.

All of these capabilities should be available through a simple, easy to use soldier-machine interface (SMI), with an on-line help facility. The interface should be a graphic user interface (GUI), using either icons, pull-down menus, or a combination of both. In any case, the system must be designed so that it enables the staff officer to perform his duties more easily and efficiently than doing the same job manually. As COL Dean Anderson said in his article, "Modernizing Army Command and Control:" "Personnel involved in C2 functions have justifiably low tolerance for devices and processes that appear to complicate their jobs."[14]

Use Currently Available Technology.

The final requirement for the TA/ACC C2 system is that it should use hardware, software, and communications systems (including protocols) which are currently available. This can include commercially available systems and existing

Government equipment. The workstation should be capable of multi-tasking, graphics and text processing, and running both MS/DOS and UNIX-based applications. The data base and data base management system should be a commercially available, relational data base system; this state-of-the-art method of data management lends itself to the high volume and wide variety of data which must be available to the TA/ACC Commander and staff. The data base should reside on dedicated "data base machines," and be replicated at specified nodes within the network. The network should be an "Open System," in terms of its use of industry standard components, communications, and operating system software. It should use industry standard protocol suites (such as Ethernet Institute of Electrical and Electronic Engineers (IEEE) 802.3 Transmission Control Protocol/Internet Protocol (TCP/IP) for local area networks, and packet switching X.25 TCP/IP for wide area networks). The communications links should be those included in standard military communications (DISNET, Automatic Digital Network (AUTODIN), the area communications managed by the Theater Communications Command-Army (TCC-A)), and commercial/Public Switch Telephone systems.

Summary

In summary, the C2 system for the TA/ACC should have the following specific characteristics and capabilities:

- Functional software which will assist in the accomplishment of TA/ACC missions, including the following:
  - A report writing program with the capability for aggregation and collation of diverse data into reports which present the data in a format useful to the recipients. This includes both periodically produced pre-formatted reports and ad hoc queries against the data base.
  - The capability to track reception, staging and forward deployment of incoming units.
  - Visibility of the flow of units into the AOR.
  - Unit and personnel status reporting.
  - Production of various types of correspondence, including operations plans and orders, memoranda, daily staff/organization logs, messages, etc.
  - Location/status of supplies, POL, ammunition, and material.
  - Transportation information (schedules, supply routes, etc.).
  - Production of graphic products, including maps, charts, and overlays.
    (Note that some of this software is available either commercially, or as a non-developmental item (NDI) already produced by the Government; other software may have to be developed due to the specificity of the requirement. For example, word processing software may be acquired commercially, but software to track unit reception, staging, and forward deployment would have to be written.)
- Separate relational data bases for subordinate organizations, and system-wide relational and sequential access TA/ACC data bases.
- Automatic network-wide data element update, and network-wide visibility of updated data on the TA/ACC data base.
- Safeguards on the data base which place restrictions on who may update specific data elements.

- Secure communications links (achieved through data encryption). The system should allow for the processing of up through SECRET-high data.
- Flexible design to allow the use of multiple types of communications means and ADP hardware.
- Expandability to allow for the growth of the TA/ACC as the Theater matures.
- Redundant communications links to provide reliability.
- Dial-up, as well as hard-wired entry into the data communications network.
- Rugged, proven ADP and communications hardware.
- Workstations which may operate in stand-alone mode, as well as network mode.
- The capability for either automated or manual interface with other DoD communications and C2 systems, including the DISNET, the Worldwide Military Command and Control System (WWMCCS), and the Army Tactical Command and Control System (ATCCS).
- Office automation capabilities (including word processing, spreadsheet, local data base, calendar, and automated message coordination).
- A briefing support system which includes graphics capability (the capability to produce text and graphic charts, interface with a map data base, etc.).
- File transfer capability throughout the system.
- System-wide electronic mail (E-mail) capability.
- The capability to generate and coordinate messages in multiple formats (free text, command-unique, and USMTF).
- A standardized, user-friendly soldier-machine interface (using icons, windows, pull-down menus, or a combination of these).

STRAWMAN C2 SYSTEM TO SUPPORT THE TA/ACC

The previous sections of this document discussed the organization and functions of a TA/ACC, and the requirements for a C2 system which would link the elements of the organization and support its functions. In this section, a proposed TA/ACC C2 system which meets these requirements

will be presented. It will be based upon currently available technology, and will present a theoretically workable (though untested) C2 system prototype. This section will be followed by a description of the TA/ACC C2 system which is currently being fielded by the Army. The two systems will be compared, and recommendations (if any are needed) will be made.

Architecture.

The TA/ACC C2 System would use a standardized architecture which would allow it to be configured to support the specific requirements of different Theater Armies. The architecture is as shown in Figures 5, 6, and 7.

The TA/ACC C2 system is envisioned to be a "network of networks." It would consist of local area networks (LAN) at the TA/ACC headquarters and subordinate command headquarters. These LANs would be tied into a wide area network (WAN) which supports the Theater. A typical LAN is shown at Figure 5. It is envisioned that LANs at the subordinate headquarters may also service units under those headquarters (i.e., the TAACOM LAN may include the headquarters of units subordinate to the TAACOM, such as the Material Management Center (MMC), depending upon the

physical proximity of the subordinate units and their information processing requirements). The exact configuration of each LAN would be predicated upon the functions performed by the headquarters being serviced, and by the number of users requiring LAN connectivity within each headquarters. The transmission medium for these LANs would either be coaxial cable or fiber. Remote users would be able to connect into the LAN via dial-up communications through a device called a Terminal Server.

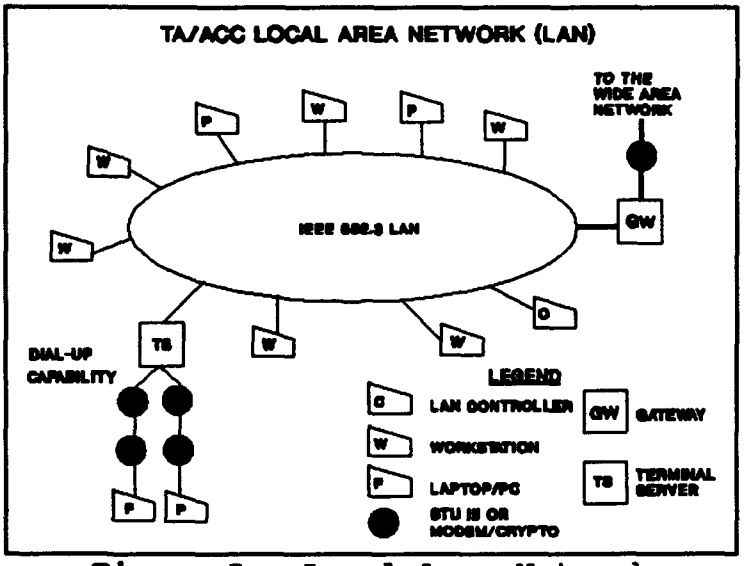

Figure 5. Local Area Network (LAN).

The data base(s) for the headquarters which the LAN services would be resident (either on the LAN controller, or on a separate micro-computer designated as a data base server). In addition, the LAN would have the capability to accept secure dial-in communications via STU III (or modem/crypto combination).

The LANs would connect into the wide area network, either by being wired directly into the packet switch node (PSN), or through the use of telecommunications (see Figure 6.). Direct connected LANs would go through a Gateway directly into the PSN. These LANs would be in close physical proximity to the facility housing the PSN. Remote LANs would connect into the WAN by going through a Gateway to a STU III (or modem/crypto combination) over any available circuit to another STU III (or modem/crypto combination) and into the wide area network packet switching node (PSN). This type of connectivity would allow for maximum flexibility with regard to the physical locations of the system components and the available communications links. It would also contribute to the mobility of the system--units may disconnect, move, and re-connect into a different PSN when they reach their next location. Note that the PSN should allow the interface of either individual workstations or entire LANs.

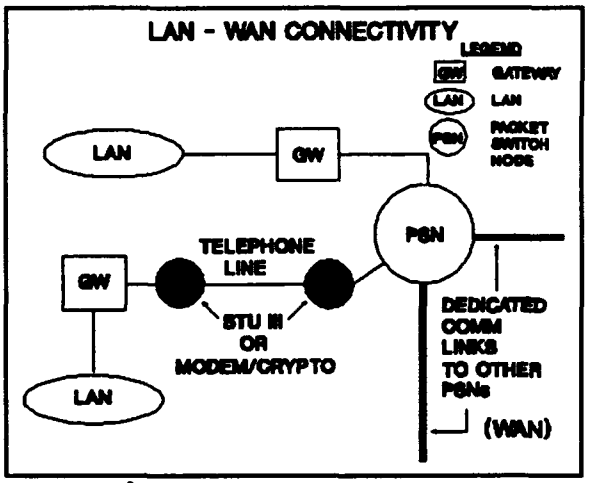

Figure 6. LAN - WAN CONNECTIVITY.

As Figure 7 shows, the wide area network (WAN) would consist of PSNs, each of which is connected via dedicated

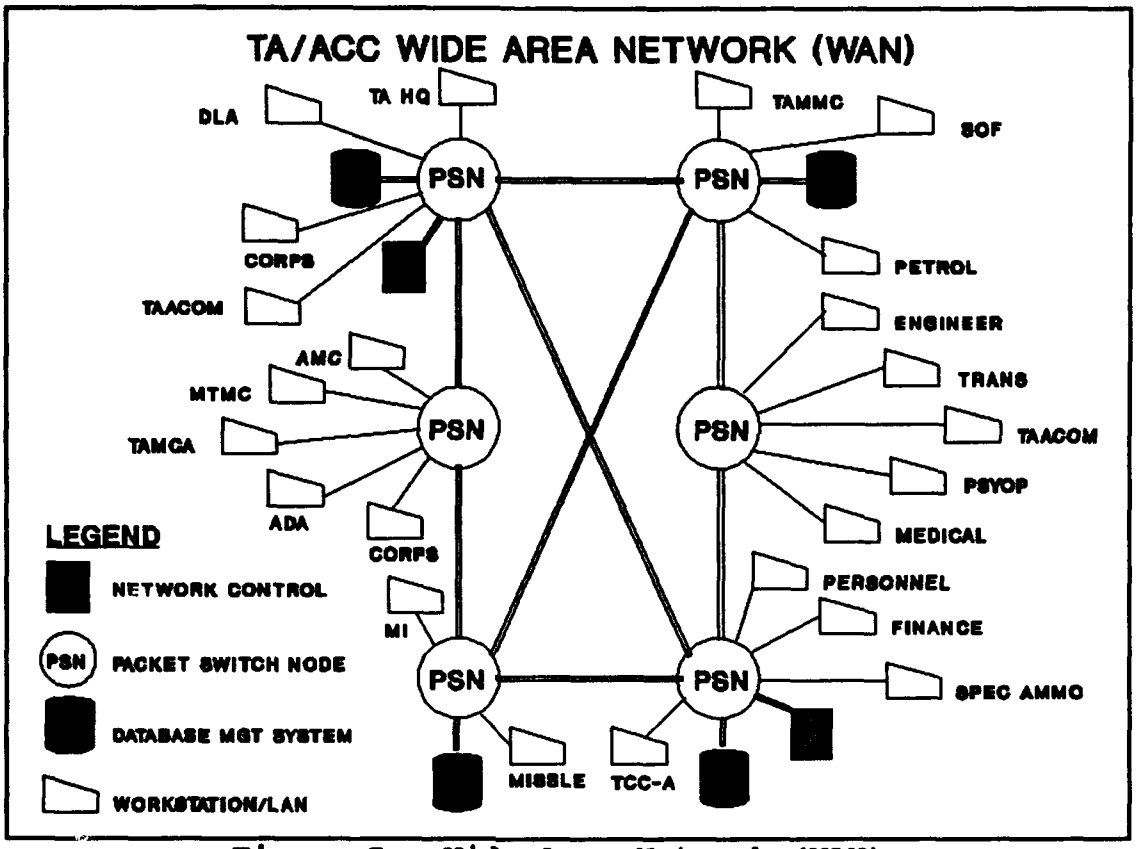

Figure 7. Wide Area Network (WAN).

communications circuits to at least two other PSNs. This would ensure a robust, redundant communications network which may be expanded by adding additional PSNs and communications links. The TA/ACC WAN would be controlled by a network controller, located at the Theater Communications Command-Army (TCC-A) Headquarters and connected to the TCC-A PSN. An alternate network controller would be located at the TA/ACC Headquarters, and would be connected to a different PSN. This would allow the network to remain active when the TA/ACC Headquarters moves: one network controller would exit the net, relocate to the new site, and set up; once communications are re-established with the

network, the other network controller would exit the net and move. This same methodology would be followed in the movement of PSNs.

Figure 7 shows four data base machines (housing the data base management systems) on the WAN. These each house the same data bases (the TA/ACC data bases), and provide redundancy and reliability. When an update is received from a LAN (either from the update of a specific data element on a LAN data base, or from a transaction which updates the TA/ACC data base only), it is automatically forwarded to all data base machines in the WAN. The network shown in Figure 7 is generic, and would support the TA headquarters shown at Figure 3. The symbol shown for a workstation may either be a single workstation (at, for example, the Military Traffic Management Command (MTMC) port facility), or it may be an entire LAN (at the Personnel Command (PERSCOM) Headquarters).

Communications.

The WAN would be a packet-switched network over dedicated communications links, using X.25 and TCP/IP communications protocols. The LANs would use either coaxial cable or fiber optics, and would run under Ethernet IEEE 802.3 and TCP/IP communications protocols. These

communications protocols and transmission media are all in existence today, and are standard within the industry.

Data Base.

The C2 system would have both relational and sequential access data bases, depending upon the type of information being stored. For example, the map data base would be a sequential access data base; unit-related data would be stored on a relational data base. The primary system data base for LANs and the WAN would be relational, and would reside on dedicated microcomputers (on the WAN). Subordinate organization-unique data bases may optionally reside on dedicated microcomputers on the LANs as well (or they may reside on the microcomputer which functions as the LAN controller). There are numerous commercially available relational data bases. The TA/ACC C2 system would use the ORACLE Relational Data Base Management System (RDBMS). It is a proven system which has been used by the Government in other applications; it uses the Structured Query Language (SQL) as the means for query/update, and has built-in safeguards for query/update control.

Workstations.

The workstations would be ruggedized micro-computers for which the contracting and purchasing agreements have already been made. They must be capable of running both MS/DOS and UNIX-based applications, and of operating as part of a network. The Hewlett-Packard 9000/300-series micro-computer (currently in use in the ATCCS system), fits these requirements. It runs under the UNIX operating system, may be equipped with a DOS co-processor, is ruggedized, and is currently under Government contract. It would be the standard "full service" workstation. In addition to a dot-matrix printer, mouse, and optional mass storage unit, it would contain all the software necessary for both network interface and stand-alone operations (including word processing, graphics briefing preparation system, spreadsheet, Ethernet card, MTF message generation software, electronic mail (E-mail) software, message coordination system software, calendar, calculator, and internal ORACLE data base capability). The soldier-machine interface for this hardware would be a GUI in order to make the system as user-friendly as possible. This microcomputer would also serve as the platform for the LAN controller and the WAN controller, and as the data base machines for both the LANs and WAN.

In addition to the "full service" workstation, the network would have the capability to provide limited services to micro-computers which operate only under MS/DOS (such as the Z-248 microcomputers, and Z-184 laptops) Many Army units are currently equipped with these computers. These limited services would include file transfer and E-mail capability, data input into the system (the upload of ASCII files containing readiness data, for example), and limited data base query capability. Liaison personnel equipped with laptop computers and STU III telephones may gain access through dial-in ports.

Packet-Switch Nodes.

The PSN's would be commercially available minicomputers which may be configured (through hardware modifications and software) to function as store-and-forward packet switching systems. The strawman TA/ACC C2 system would utilize the Honeywell Level 6 minicomputer. This is a minicomputer which is configurable in several ways, one of which is as a packet switch node. It has seen service in other Government-owned networks as a PSN, and could perform the function adequately.

Encryption/Decryption Devices.

The cryptographic equipment used by this system would either be the STU III secure telephone unit, or the KG-84A encryption/decryption devices. These are both NDI, and both currently available under Government contracts.

Gateways/Terminal Servers.

The network gateways and terminal servers used by the TA/ACC system would be manufactured by *cisco* Corporation; *cisco* products are industry standard systems, and are also available under Government contract.

Summary.

The system described above represents the high-level design of a prototype which should fill the C2 system needs of the TA/ACC. It is secure, uses technology which is available under Government contract today, and has an architecture which is both flexible and expandable. In the next portion of this document, the system which is actually being developed to fill the TA/ACC C2 requirements (STACCS) will be discussed.

STANDARD THEATER ARMY COMMAND AND CONTROL SYSTEM (STACCS)

The Standard Theater Army Command and Control System (STACCS) is being developed under the auspices of the Program Executive Officer for Command and Control Systems (PEO-CCS). The Material Developer is the Program Manager for Operational Tactical Data Systems (PM OPTADS), and the Combat Developer is the Combined Arms Center (CAC), U.S. Army Training and Doctrine Command (TRADOC). The Product Manager for STACCS is subordinate to the PM OPTADS; he also works closely with the 5th Signal Command and the U.S. Army Europe (USAREUR) Deputy Chief of Staff for Information Management (DCSIM).

History

STACCS is the beneficiary of the excellent work done over the past several years by the 5th Signal Command's Command and Control Support Agency-Europe (CCSA-E), and the office of the Project Manager for Army WWMCCS Information Systems/Command and Control Systems (PM AWIS/CCS), on the USAREUR Tactical Automated Command and Control System (UTACCS). Responsibility for the UTACCS program was formerly shared by CCSA-E and PM AWIS/CCS under the PEO for Strategic Information Systems (PEO-SIS). In a recent reorganization PEO-SIS was disbanded, PM AWIS/CCS became PM

AWIS, UTACCS became STACCS, and the product management of STACCS was moved from PM AWIS to PM OPTADS. This was done to consolidate responsibility for Army C2 systems below the strategic level. PM OPTADS now has responsibility for STACCS and for the Maneuver Control System (MCS). MCS is part of the Army Tactical Command and Control System (ATCCS). These are the C2 systems which will support a Theater Army or Army Component Command: STACCS will support echelons above corps (EAC), MCS will support echelons corps and below (ECB). This arrangement should greatly enhance the interoperability of these systems, thus providing increased speed and reliability in the information flow between the operational and tactical-level units in the Theater.

The basic system architecture and the software development for what has become STACCS were done under the UTACCS program by the Product Manager UTACCS, in conjunction with the organizations listed above, and a number of defense contractors (including TRW Inc., and TechDyn Systems Corporation). In January 1990, USAREUR declared initial operational capability (IOC) for UTACCS, making it a standard system for that Theater; one year later (in January 1991), the Major Automated Information System Review Council (MAISRC) in-process review (IPR) made the decision to use UTACCS as the basis for what is to become the Standard

Theater Army C2 System.[15] As a result of that decision, PM UTACCS became PM STACCS.

Because of its close ties to USAREUR (replacing a system for which IOC had been declared), the first iteration of STACCS is being fielded using the UTACCS network already operational in Europe. In order to more fully support that effort, PM STACCS is continuing to maintain offices in Heidelberg, Germany, and at Ft Monmouth, NJ.

The initial version of STACCS is currently undergoing evaluation and validation in Europe. In the future (depending upon funding), STACCS will be installed at U.S. Army Forces Southern Command (USARSO) in Panama, and at Eighth U.S. Army (EUSA), Korea. Because each of these headquarters has certain unique mission requirements, STACCS will be tailored to accommodate them. However, the basic system architecture will remain the same; the tailoring will consist of the addition of command-unique required capabilities.

A subset of STACCS (called the ARCENT Command and Control Information System (AC2IS)) was installed in Saudi Arabia during Operation Desert Shield/Desert Storm, with yeoman support from PM STACCS and 5th Signal Command. Hardware, software, and personnel (including military

personnel and civilian contractors from TRW Corporation) were deployed to Saudi Arabia. The original mission of these personnel was twofold: install the system, and train Army Forces Central Command (ARCENT) personnel in its operation. Due to a lack of available personnel at ARCENT, several individuals from 5th Signal Command stayed in Saudi Arabia throughout most of Desert Shield/Desert Storm, and provided invaluable service in the installation, engineering, and operation of the system. By the time they were finished, there was a wide area network which spanned the northern half of the country, with packet switch nodes in Dhahran, Damman, Riyadh, and King Kahlid Military City (KKMC). Local area networks were established or workstations were installed at ARCENT Headquarters, the forward logistics center at KKMC, the PERSCOM, the Support Command (SUPCOM), the Transportation Command (TRANSCOM), the MMC, the ASG, and the Signal Brigade.[16] There were also connections out of the WAN into DISNET which enabled secure communications to occur with USAREUR, Forces Command (FORSCOM), and with ARCENT Rear in the Continental U.S. (CONUS). Although the entire suite of STACCS capabilities was not installed, the system subset was well-received by ARCENT Headquarters and its subordinate units. That hardware and software is currently being redeployed from Saudi Arabia, and is being installed for garrison use (with rapid deployment capability) at Third U.S. Army (TUSA)

Headquarters, Ft McPherson, GA. (Note: when deployed, TUSA becomes the Army Component of U.S. Central Command (ARCENT)).

General

STACCS has been designed to support TA/ACC operations throughout the continuum of operations, including peacetime activities, transition to war, and war. See Figure 8. Note that the functions (force planning, force reception, etc.) listed under the major headings (peace and crisis, transition to war, war) are the basis for the applications software which STACCS provides (or will provide) to the TA/ACC.

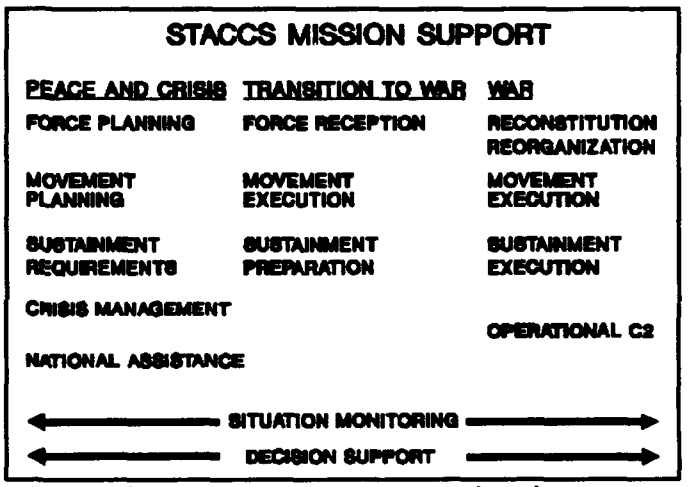

Figure 8. STACCS Mission Support

The following information, taken from a briefing presented by PM STACCS,[17] describes the STACCS system:

- Processes at the SECRET level and below.

- Provides decision support and enhances timeliness, efficiency, reliability, and security of data distribution.
- Provides peacetime, crisis, transition to war, and wartime command and control capability.
- Is a transportable, Theater-wide system supporting the Headquarters, major commands, subordinate commands, and selected echelons above corps.
- Interfaces with selected joint services and combined services at the strategic level, as well as echelons corps and below systems (i.e., the MCS subsystem of the Army Tactical Command and Control System (ATCCS)).

Global Network

STACCS envisions an architecture which will ultimately span the globe.[18] It will consist of a "global WAN" connecting selected major U.S. Army Headquarters (including Headquarters, Department of the Army (HQDA), FORSCOM, USAREUR, TUSA, EUSA/U.S. Army Pacific (USARPAC), and USARSO/U.S. Southern Command (SOUTHCOM)).

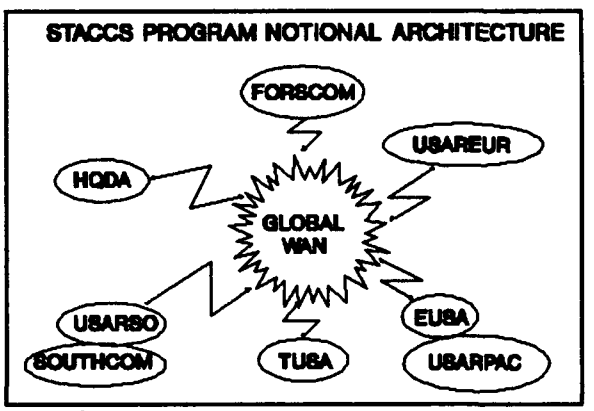

Figure 9. STACCS Program Notional Architecture.

See Figure 9. STACCS will eventually have automated, data element interfaces with the Maneuver Control System, Combat Service Support Computer System, Advanced Field Artillery Tactical Data System, All-Source Analysis System - Echelons Above Corps Intelligence Center, General Support Integrated Meteorological System, Digital Topographic Support System, WWMCCS, Contingency Tactical Air Control System Automated Planning System, the Theater Army Command and Control Information Management System (TACCIMS--the bi-lingual C2 system being developed for Combined Forces Command in Korea[19]), and United Press International.[20]

Functionality

STACCS currently supports (or will support) applications processing in twelve functional areas; these areas and the support provided are listed below:[21]

Functional Area	Application
Medical	Collect, summarize, and report information needed for the management of medical assets.
Operations	Provide unit readiness data, unit status reporting, movement control readiness reporting, sustainment, and force tracking of deployed or deploying units.
Information Management	Provide operating status of information management systems by command functional area.
Provost Marshal	Collect, analyze, and disseminate data on enemy prisoners of war (POW), civilian internees, and serious incident information.

Functional Area	Application (Continued)
Host Nation Support	Collect, monitor, analyze, and summarize activities ongoing and planned under the auspices of bilateral agreements and special contracts with host nations.
Personnel	Collect, summarize, and report unit critical personnel requirements and current posture by major subordinate commands.
Transportation	Provides the capability to plan, execute and manage the employment and deployment of transportation assets. (Note, the system which provides this capability is called the Movement Control and Readiness Reporting System (MCRR); it is also used in the Operations functional area).
Engineer	Provides the status of lines of communication and ongoing engineer projects to support the TA/ACC mission to sustain and reinforce the combat, combat support, and combat service support forces.
Intelligence	Provide the capability to collect, assess, analyze, and disseminate critical intelligence data and nuclear/chemical data (including nuclear/chemical weapons deployment, global weather, and security information pertaining to users having access to STACCS).
Maintenance	Collect and evaluate maintenance data on major end items of equipment.
Supply/Logistics	Provide the status of various classes of supply, including ammunition, bulk petroleum, oils, and lubricants (POL), subsistence, critical major end items, repair parts, and limited status of supply site capabilities.
Civil Affairs	Collect, analyze, and evaluate political and military information and enable the user to develop a civil-military operations estimate.

Software

STACCS software design uses a layered approach which overlays software on the basis of its function.[22] See Figure 10. The lowest layer of software is the System Support Software (including System Services, Communications, the Operating System, the Window System, and the Data Base Management System). These software packages are, for the most part, industry standard, commercially available systems. The next layer is the STACCS Support Software; it includes the Soldier-Machine Interface, Information Handling system, Data Distribution system, PC Interface Services, ADP Control and Monitor systems, and Network Control and Monitor Systems. The highest layer is the STACCS Applications Software; this layer includes the Message Applications system, Data Bases, Situation Assessment/Map Graphics system, Briefing system, and Office Automation system.

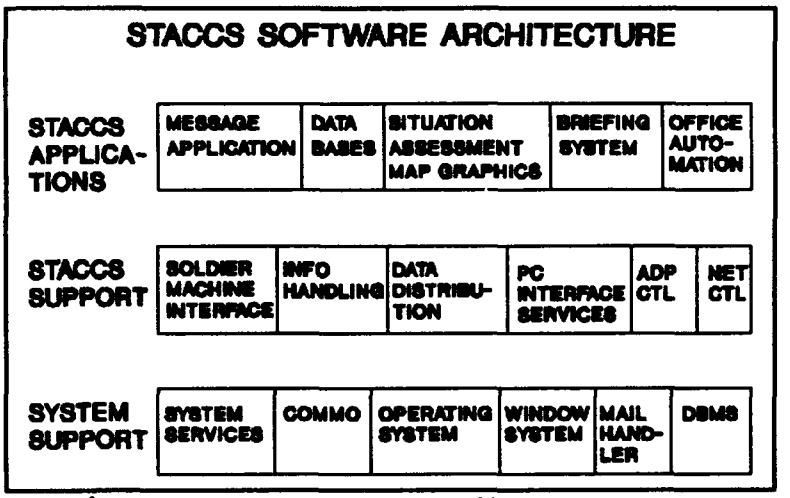

Figure 10. STACCS Software Layers

STACCS software (including system support software, STACCS support software, and applications software) is being released in increments.[23] Initially a Version 1.0 baseline is being distributed for all of these groups. Version 1.0 for the STACCS Support Software and System Support Software consists of the following:

- Graphics Support
  - Presentations (User-generated briefing capability)
  - Background Display (Background display of digitized maps with user selected/created overlays)
- Data Distribution
  - Reliable data base updates
  - User access data base system
  - Comparator
- PC Interface
  - PC mail processing
  - File Transfer
  - Data entry terminal for applications
- Soldier-Machine Interface
  - User-friendly environment
  - Commonality with ATCCS hardware
- Messaging and Message Handling
  - Transmits, receives, distributes, and manages incoming and outgoing messages
  - USMTF parser/display
  - DISNET compatibility
  - Free text interface to ATCCS (Maneuver Control System (MCS)
- Communications and Network Management
  - Connectivity for STACCS and systems management

Version 1.0 of the STACCS Applications Software will consist of the following:

- Friendly Situation
  - Position and status data
  - Situation map overlay
- Enemy Situation
  - Position and status data
  - Situation map overlay
- Nuclear/Chemical
  - NBC 3/5 reports
  - Predicted/actual contamination areas
  - Situation map overlay
- Movement Control and Readiness Reporting System (MCRR)
  - Time-Phased Force Deployment Data (TPFDD) extract
  - Unit Readiness data
  - Movement data (movement planning, tracking, and execution data)
- Force Tracking
  - Carrier status
  - Unit movement tracking
  - Unit movement data
  - Unit readiness status
  - Situation map overlay
- Staff Journal/Emergency Action
  - Generate significant event reports
- Information Management
  - Status/outages of ADP and communications equipment
- Intelligence
  - Intelligence spot reports
  - Base threat and vulnerability data
- Logistics
  - Transportation data on port, vessel, and airfields in Theater
  - Critical item data on Class I, II, III, IV, V, VII, and IX
- Medical
  - Army hospital data
- Personnel
  - Daily on-line PERSITREP

- PM
  - POW status
- Engineer
  - Data on Engineering projects
- USAREUR Provided New Modules (being provided outside the STACCS program by USAREUR--will require integration into STACCS)
  - CINC force analyzer
  - BASES (selected information on military installations in the AOR)
  - Army Special Operations Forces Europe
  - Automated resource directory

Future applications software for STACCS include:[24]

- Armistice Support
- Decision Support System
- Strategic/Joint/Combined Interfaces
- Sustaining Base Interfaces
- Drug War Support
- Message Traffic Interface and Management
- Maneuver Control System (MCS) Data Base to STACCS Data Base compatibility:
  - Enemy/Friendly Situation
  - Nuclear/Chemical Activity
  - Logistics
  - Control Graphics
- Transition to War Deployment Planning and Coordination
- Logistical Planning

Data Bases

The data base management system (DBMS) for STACCS consists of redundantly distributed relational data bases. There are data base machines at selected packet switch nodes, each having a copy of the system-wide data base. As changes/updates to the data base are received from the LANs at the PSN, its data base machine is updated and the transaction sent to the other PSNs having data base

machines. This provides a reliable, robust system for ensuring data availability throughout the network. The DBMS used by STACCS is the INFORMIX DBMS; it is a commercially available, relational data base system which uses the industry standard Structured Query Language (SQL) as its query/update language, and has built-in safeguards for query/update control. The data base machines are the HP 9000/375.

Architecture

The STACCS system architecture uses the "network of networks" concept. It consists of local area networks (called LAN nodes) at the TA/ACC headquarters, and at the headquarters of major subordinate organizations. These LAN nodes are connected into the wide area network, which consists of packet switch nodes (called WAN nodes) and dedicated communications links. The LAN node communications path into the WAN node is encrypted, and may go over a

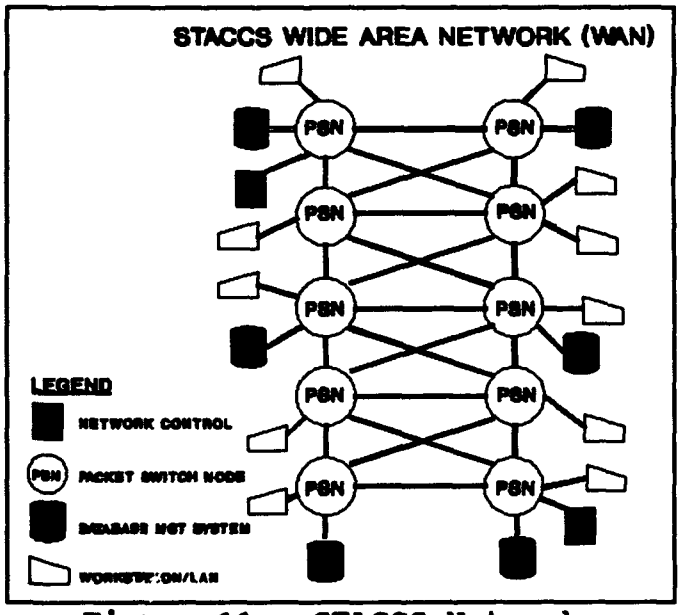

Figure 11. STACCS Network.

variety of communications means. See Figure 11. Notice that each of the packet switch nodes has multiple paths to other nodes, and that selected nodes have data base machines. The WAN uses DDN X.25 and TCP/IP communications protocols. The WAN is designed to function over communications circuits with line speeds ranging from 4.8 to 56 kbps.[25]

Hardware

An enlargement of a STACCS WAN node is shown at Figure 12. Note the multiple communications paths out to other WAN nodes. The WAN Server, System Management Console, and External Gateway are optional devices and will not be found at every WAN node. The WAN Server and System Management Console combine to form the Network Operations Center (NOC)[26], which is used to control the WAN. There are normally two NOCs, a primary and an alternate. The External Gateway, when present, connects the WAN into systems such as the Defense Digital Network. The communications protocol used between the LAN and WAN

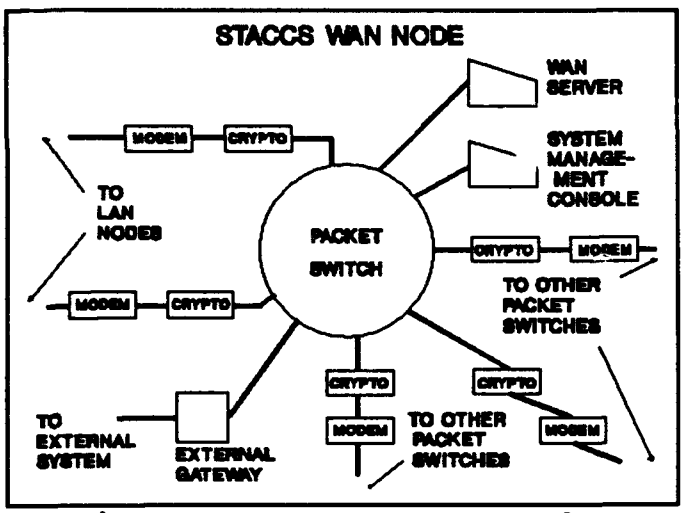

Figure 12. STACCS WAN Node.

nodes is DDN X.25; line speed typically varies from 1.2 to 56 kbps (depending upon the communications links and modems in use on a particular circuit)[27]. Up to 10 LAN nodes may be connected to each PSN using either KG-84 encryption devices and modems or STU III telephones.[28] Hardware used in the WAN includes the following[29]:

Packet Switch Node:	Bolt, Beranek, and Newman (BBN) C/3R
Network Gateways:	*cisco*
WAN Server:	HP 9000/375
Network Management Console:	HP 9000/375 (or HP 9000/380)
Modems:	Hayes compatible or STU III
Cryptographic Equipment:	KG-84 or STU III

The STACCS LAN node is shown at Figure 13. The STACCS LAN is a standard IEEE 802.3 Ethernet LAN, using TCP/IP protocols.[30] The communications medium is fiber optic cable. The LAN will service both the STACCS workstations (also called Analysts Consoles)[31], and MS/DOS-based personal computers (which may be used for data entry and limited network services). Hardware included in the LAN includes the following:[32]

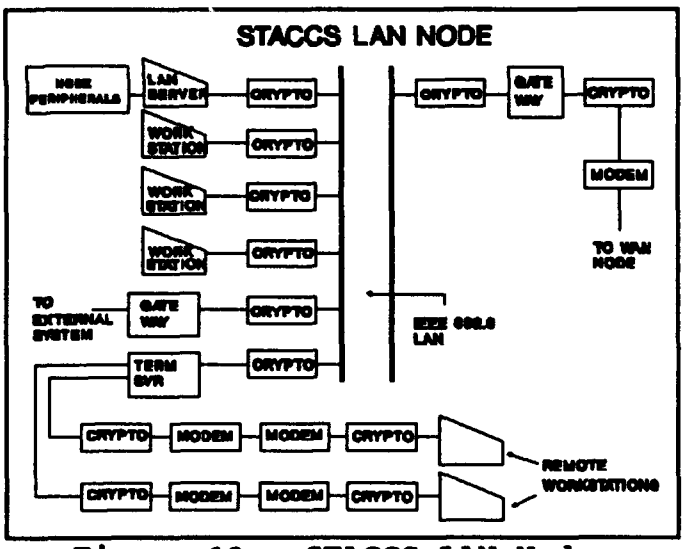

Figure 13. STACCS LAN Node.

LAN Server:	HP 9000/375
Analyst Consoles: (Workstations)	HP 9000/375 w/peripherals (including printer, mouse, and mass storage device (MSEU))
Terminal Server(s):	*cisco*
Transceivers:	Fibercom
Fiber Optic Cable	
Network Gateway:	*cisco*
Modem:	Hayes compatible or STU III
Cryptographic Equipment:	KG-84 or STU III
Equipment Transport Cases	

Workstations used within STACCS include the full-blown STACCS analyst console (described above) and the MS/DOS-based PC. The services available to users equipped with the PC are somewhat reduced as compared with those available to users equipped with analyst consoles. PC users have data entry and limited retrieval capability; they are able to create files, draft messages, and use word processing, spreadsheet, and telecommunications software. The analyst console offers its user the full suite of STACCS capabilities. Included on the analyst console are the UNIX operating system, MS/DOS co-processor, Word Perfect 5.x word processing, message processing software, the INFORMIX DBMS, UNIPLEX Integrated Business Package, and the HP X11-Motif Windows package (part of the soldier-machine interface).

Summary

STACCS is a powerful, proven system which has been built around the "real world" C2 requirements of a deployed

Theater Army/Army Component Command Commander and his Staff. It has shown its worth in both peace and war. In a recent briefing, Mr. Paul Strassmann (Director of Defense Information, Office of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence) stated that deployable ADP systems should be, "standard, vendor-independent, modular, scalable, inter-operable, flexible, secure, survivable, portable, redundant, damage-resistant, low-cost, long-life, commercial, adaptable, plug-together elements."[33] STACCS meets the majority of these characteristics. It provides a series of usable "tools" to assist in the command and control of a large, complex organization. With the U.S. National Military Strategy's increasing emphasis on the capability for rapid deployment of CONUS-based forces to answer regional contingencies, a C2 system like STACCS will be indispensable--it will assist the Army Component Commander in being able to rapidly develop the Theater through the timely and accurate capture of the types of information he will require (including the reception, staging, and onward movement of incoming units, visibility of all classes of supply within the Theater, data on the friendly and enemy situation, and communications with higher, adjacent, and subordinate organizations--including organizations in CONUS). It is a mobile, reliable, system which can be installed quickly and expanded as the needs of the TA/ACC dictate. Most important, it provides a

standardized system for supporting the functions of a deployed TA/ACC in virtually any part of the world.

COMPARISON OF SYSTEMS

The strawman C2 system and STACCS both meet the requirements set forth for a command and control system which supports a deployed TA/ACC:

- Each system provides the following functional software capabilities:
  - A report writing program with the capability for aggregation and collation of diverse data into reports which present the data in a format useful to the recipients, including both periodic and ad hoc reports.
  - The capability to track reception, staging and forward deployment of incoming units.
  - Visibility of the flow of units into the AOR.
  - Unit and personnel status reporting.
  - Production of various types of correspondence, including operations plans and orders, memoranda, daily staff/organization logs, messages, etc.
  - Location/status of supplies, POL, ammunition, and material.
  - Transportation information (schedules, supply routes, etc.).
  - Production of graphic products, including maps, briefing charts, and overlays.
- Each system provides separate integrated data bases for subordinate organizations, and for the Theater as a whole.
- Each system provides for automatic network-wide data element update, and for safeguards on who may initiate updates of specific data elements.
- Each provides a secure communications system which allows the passage of data which is classified up to and including SECRET.
- The design of each is flexible (allowing the use of multiple types of communications means and ADP hardware).
- Each system is expandable.
- Each system provides redundant communications capability.

- Each system provides the capability for network entry via either dial-up or hard-wired communications.
- Each system uses ADP and communications hardware which is rugged, proven equipment (much of which is already in-use in Army units).
- Each system contains workstations which may operate as stand-alone desktop computers, or as part of the network.
- Each system provides the capability for either automated or manual interface with other DOD communications and C2 systems.
- Each system provides office automation capabilities.
- Each system provides a briefing support system.
- Each system provides E-mail and file transfer capability throughout the network.
- Each system provides the capability to generate and coordinate messages in multiple formats.
- Each system provides a standardized, user-friendly SMI.

In addition, STACCS provides the following functional software capabilities not found in the strawman C2 system:

- A Information Management module which maintains information on the network status/outages.
- An Intelligence module which processes Intelligence spot reports and maintains information on base threat and vulnerability data.
- A Medical module which provides Army hospital information.
- A Provost Marshal module which provides prisoner of war (POW) status information.
- An Engineer module which provides information pertaining to ongoing Engineer projects.
- Future software modules, including Armistice Support, a Decision Support System, more interfaces to external systems (including sustaining base systems), Drug War support system, etc.

There are also some USAREUR-provided modules (CINC Force Analyzer, SOF-Europe support module, etc.) which are outside the purview of the current STACCS development effort. However, if any of these modules provide a

capability which might be useful to TA/ACC Commanders other than CINCUSAREUR, they will probably be integrated into the STACCS software suite.

Though each of the C2 systems provides the capabilities listed as being required by a deployed TA/ACC, STACCS is clearly the superior of the two. It provides additional capabilities, based on the requirements which evolved from its "real world" support of U.S. Army Europe (both as UTACCS, and now as STACCS). It is up and running, and has proven its worth in the communications-rich environment of the European Theater, as well as in the harsh, "bare bones" communications environment of Saudi Arabia.

CONCLUSIONS/RECOMMENDATIONS

The deployed TA/ACC requires a C2 system like the ones described herein to efficiently handle the tremendous amounts of information which must be exchanged in a timely manner within an organization of its size and complexity. STACCS has evolved out of "real world" requirements, and has been designed and built to satisfy those requirements. The "network of networks" architecture is the most feasible alternative to providing a framework which supports this information exchange. Standard, user-friendly applications programs and soldier-machine interfaces with those programs

make the utility of the system obvious to the users, and increase its acceptance and use. This standardization also increases the utility of the system between Theaters; individuals (or units) who transit from one Theater Army area to another will become productive in a shorter period of time since they will not have to learn a new C2 system (with its different hardware, procedures, etc.).

One drawback to a sophisticated C2 system of the type described in this document is that it will require an organization to administer and maintain it. While the operation of the individual workstations (and probably LAN administration duties) will be the responsibility of the unit or organization in which the workstations and LANs are located, the installation, administration, and maintenance of the total TA/ACC system would require a separate group of people. These would include technical support (hardware, software, and communications) personnel, managers, and trainers. This organization could either be a part of the Theater Army G6 section, or the TCC-A. In USAREUR, these functions are being handled by 5th Signal Command. In Saudi Arabia, they eventually came under the Information Services Division of the ARCENT G6. In any case, there will be some personnel and organizational overhead associated with this type of C2 system.

One other consideration regarding this type of C2 system is the need for dedicated communications links between the WAN nodes, and for DISNET access in order to allow communications outside the AOR. In a "bare bones" environment, this communications overhead could present difficulties; however, the benefits which accrue from the use of this system should justify a high position on the communications priority list. The speed of its E-mail and file transfer capability will greatly enhance operational efficiency within the TA/ACC. As an example, during Operation Desert Shield, much of the hard copy traffic between ARCENT Headquarters and its subordinate units (as well as between ARCENT Headquarters and CONUS) was done using facsimile (FAX) machines connected to standard telephone lines. Each of these "FAXes" took from 30 seconds to one minute per page to process. A file transfer over the STACCS system can occur from any point in the network in a matter of seconds. The installation of the STACCS subset in Saudi Arabia virtually eliminated the FAX machine lines at the locations having STACCS workstations. This in itself saved a tremendous amount of communications resources. So a C2 system which uses the architecture described herein requires dedicated communications resources, but it can also save communications resources. It also requires dial-up links between the LANs and the PSNs, but these would not be used on a continuous basis. Communications planners will

have to take these needs into consideration when looking at the requirements of a deployed TA/ACC equipped with STACCS.

This document began with a quote from Sun Tzu stating that, "control of many requires organization, formations, and signals." The C2 system for a deployed TA/ACC is based on these three basic factors. It has evolved into a complex system which supports the command and control of a large, multi-faceted organization. With our National Military Strategy orienting on the rapid deployment of CONUS-based forces into areas of regional conflict, a TA/ACC Commander and his staff must have virtually instant access to information pertaining to a wide spectrum of topics (from unit status and location, to logistic data, to information on enemy forces), and secure, reliable communications (locally and globally) with higher, adjacent, and subordinate organizations. STACCS will provide the framework for ensuring the availability of both the required information and communications.

ENDNOTES

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[4]U.S. Department of Defense, Joint Pub 1-02: Department of Defense Dictionary of Military and Associated Terms (Washington, D.C., 1 December 1989), p. 77.

[5]Department of the Army, FM 100-16: Support Operations: Echelons Above Corps (Washington, D.C., April 1985), pp. 1-3 - 1-4.

[6]Headquarters TRADOC, FM 100-7: The Army in Theater Operations (Draft) (Ft. Monroe, 31 August 1990), p. 3-7.

[7]U.S. Army Combined Arms Combat Developments Activity, Standard Theater Army Command and Control System (STACCS) Operational Requirements Document (ORD) (Draft) (Ft. Leavenworth, 5 August 1991), p.2.

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[9]Department of the Army, FM 100-16: Support Operations: Echelons Above Corps (Washington, D.C., April 1985), p. 1-4.

[10]Ibid., 1-4.

[11]Ibid., 2-6.

[12]Ibid., 2-4.

[13]Ibid., 1-4, 1-5.

[14]Anderson, COL Dean R., "Modernizing Army Command and Control," Military Review, July 1990, p. 3.

[15]Frank Nissen, "Standard Theater Army Command and Control System" briefing (30 October 1991), p. 3.

[16]TRW Corporation, "STACCS Information Briefing" (Undated).

[17]Frank Nissen, "Standard Theater Army Command and Control System" briefing (30 October 1991), p. 4.

[18]Ibid., 6.

[19]U.S. Army Combined Arms Combat Development Activity, Army Command and Control Master Plan (U), Volume I, Desktop Reference 1990 (Ft Leavenworth: 14 May 1990), p. 5-33.

[20]U.S. Army Combined Arms Combat Developments Activity, Standard Theater Army Command and Control System (STACCS) Operational Requirements Document (ORD) (Draft) (Ft. Leavenworth, 5 August 1991), p. 4.

[21]U.S. Army Combined Arms Combat Development Activity, Standard Theater Army Command and Control System (STACCS) Operational Requirements Document (ORD) (Draft) (Ft. Leavenworth, 5 August 1991), pp. 10-11.

[22]Frank Nissen, "Standard Theater Army Command and Control System" briefing (30 October 1991), p. 9.

[23]Ibid., 10, 11.

[24]U.S. Army Combined Arms Combat Developments Activity, "Standard Theater Army Command and Control System" Information Briefing (Ft. Leavenworth, undated), p. 27.

[25]TRW Corporation, United States Army Europe (USAREUR)Tactical Command and Control System (UTACCS) Segment Specification for UTACCS, Phase A - 1991 (Redondo Beach, 30 June 1989), pp. 53, 54.

[26]UTACCS Product Manager's Office, "USAREUR Tactical Automated Command and Control System (UTACCS)" Information Briefing (1990), p. 4.

[27]Ibid., p. 53, and telephone conversation with Mr. Frank Nissen, DPM STACCS (12 February 1992).

[28]UTACCS Product Manager's Office, "USAREUR Tactical Automated Command and Control System (UTACCS)" Information Briefing (1990), p. 4.

[29]Mitre Corporation, Working Paper WP-87-H-0007, "USAREUR Tactical Command and Control System (UTACCS) Operational and Organizational Plan" (Washington, D.C.: 24 August 1988), and telephone conversations with Mr. Frank Nissen, DPM STACCS (3 February 1992, and 12 February 1992).

[30]COL William J. Chantelau, "USAREUR Tactical Automated Command and Control System (UTACCS) Program Update" Briefing (July 1989), p. 22.

[31]UTACCS Product Manager's Office, "USAREUR Tactical Command and Control System (UTACCS)" Information Briefing (1990), p. 4.

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[33]Paul A. Strassmann, "Systems Integration in Corporate Information Management," Slide #4 from a briefing presented at the U.S. Army War College (28 January 1992).

LIST OF TERMS/ACRONYMS

Term/Acronym	Meaning
AC2IS	ARCENT COMMAND AND CONTROL INFORMATION SYSTEM
ACC	ARMY COMPONENT COMMAND
ACCS	ARMY COMMAND AND CONTROL SYSTEM
ADP	AUTOMATIC DATA PROCESSING
AFATDS	ADVANCED FIELD ARTILLERY TACTICAL DATA SYSTEM
AMHS	AUTOMATED MESSAGE HANDLING SYSTEM
AOR	AREA OF RESPONSIBILITY
APOD	AIR PORT OF DEBARKATION
APOE	AIR PORT OF EMBARKATION
ARCENT	ARMY FORCES, CENTRAL COMMAND
ARFOR	ARMY FORCES
ASCII	AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE
ASG	AREA SUPPORT GROUP
ASIS	ALL-SOURCE INTELLIGENCE SYSTEM
ATCCS	ARMY TACTICAL COMMAND AND CONTROL SYSTEM
AUTOVON	AUTOMATIC VOICE NETWORK
AUTODIN	AUTOMATIC DIGITAL NETWORK
AWIS	ARMY WWMCCS INFORMATION SYSTEM
BBN	BOLT, BERANEK, AND NEWMAN
BDE	BRIGADE
BN	BATTALION
BPS	BITS PER SECOND
C2	COMMAND AND CONTROL
CAC	COMBINED ARMS CENTER
CCS	COMMAND AND CONTROL SYSTEMS
CCSA-E	COMMAND AND CONTROL SUPPORT AGENCY-EUROPE
CENTCOM	U.S. CENTRAL COMMAND
CO	COMPANY
CINC	COMMANDER-IN-CHIEF
COCOM	COMBATANT COMMAND
COMMZ	COMMUNICATIONS ZONE
CONUS	CONTINENTAL UNITED STATES
COSCOM	CORPS SUPPORT COMMAND
COTS	COMMERCIAL OFF-THE-SHELF
CS	COMBAT SUPPORT
CSS	COMBAT SERVICE SUPPORT

CSSCS	COMBAT SERVICE SUPPORT COMPUTER SYSTEM
DBMS	DATA BASE MANAGEMENT SYSTEM
DCSI	DEPUTY CHIEF OF STAFF, INTELLIGENCE
DCSIM	DEPUTY CHIEF OF STAFF, INFORMATION MANAGEMENT
DCSLOG	DEPUTY CHIEF OF STAFF, LOGISTICS
DCSOPS	DEPUTY CHIEF OF STAFF, OPERATIONS
DCSPER	DEPUTY CHIEF OF STAFF, PERSONNEL
DDN	DEFENSE DATA NETWORK
DISCOM	DIVISION SUPPORT COMMAND
DISNET	DEFENSE INTEGRATED SECURE NETWORK
DIV	DIVISION
DOD	DEPARTMENT OF DEFENSE
DOS	DISK OPERATING SYSTEM
DS	DIRECT SUPPORT
E-MAIL	ELECTRONIC MAIL
EAC	ECHELONS ABOVE CORPS
ECB	ECHELONS CORPS AND BELOW
EUSA	EIGHTH U.S. ARMY
EW	ELECTRONIC WARFARE
FAX	FACSIMILE TRANSMISSION
FORSCOM	U.S. FORCES COMMAND
FY	FISCAL YEAR
GS	GENERAL SUPPORT
GUI	GRAPHIC USER INTERFACE
HN	HOST NATION
HNS	HOST NATION SUPPORT
HP	HEWLETT PACKARD
HQ	HEADQUARTERS
HQDA	HEADQUARTERS DEPARTMENT OF THE ARMY
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
IOC	INITIAL OPERATIONAL CAPABILITY
IPR	IN-PROCESS REVIEW
JCS	JOINT CHIEFS OF STAFF
JINTACCS	JOINT INTEROPERABILITY OF THE TACTICAL COMMAND AND CONTROL SYSTEM
JS	JOINT STAFF
JTF	JOINT TASK FORCE
KBPS	KILOBITS PER SECOND
KG-84	KEY GENERATOR MODEL 84
KKMC	KING KAHLID MILITARY CITY

LAN	LOCAL AREA NETWORK
LOC	LINES OF COMMUNICATION
MAISRC	MAJOR AUTOMATED INFORMATION SYSTEM REVIEW COUNCIL
MCC	MOVEMENT CONTROL CENTER
MCS	MANEUVER CONTROL SYSTEM
MCRR	MOVEMENT CONTROL AND READINESS REPORTING
MEDCOM	MEDICAL COMMAND
MMC	MATERIAL MANAGEMENT CENTER
MS/DOS	MICROSOFT DISK OPERATING SYSTEM
MSEU	MASS STORAGE EQUIPMENT UNIT
MTF	MESSAGE TEXT FORMAT
MTMC	MILITARY TRAFFIC MANAGEMENT COMMAND
NBC	NUCLEAR BIOLOGICAL CHEMICAL
NCA	NATIONAL COMMAND AUTHORITY
NCC	NETWORK COTROL CENTER
NDI	NON-DEVELOPMENTAL ITEM
NEO	NONCOMBATANT EVACUATION OPERATIONS
NOC	NETWORK OPERATIONS CENTER
OPCOM	OPERATIONAL COMMAND
OPCON	OPERATIONAL CONTROL
OPTADS	OPERATIONAL TACTICAL DATA SYSTEMS
PC	PERSONAL COMPUTER
PEO-CCS	PROGRAM EXECUTIVE OFFICE-COMMAND AND CONTROL SYSTEMS
PEO-SIS	PROGRAM EXECUTIVE OFFICE-STRATEGIC INFORMATION SYSTEMS
PERSCOM	PERSONNEL COMMAND
PERSITREP	PERSONNEL SITUATION REPORT
PM	PROGRAM MANAGER, PROJECT MANAGER, PRODUCT MANAGER, OR PROVOST MARSHALL
POD	PORT OF DEBARKATION
POE	PORT OF EMBARKATION
POL	PETROLEUM, OIL, AND LUBRICANTS
POW	PRISONER OF WAR
PSN	PACKET SWITCH NODE
RAM	RANDOM ACCESS MEMORY
RAOC	REAR AREA OPERATIONS CENTER
RAP	REAR AREA PROTECTION
RDBMS	RELATIONAL DATA BASE MANAGEMENT SYSTEM
SECDEF	SECRETARY OF DEFENSE
SIS	STRATEGIC INFORMATION SYSTEMS
SITMAP	SITUATION MAP

SITREP	SITUATION REPORT
SOF	SPECIAL OPERATIONS FORCES
SMI	SOLDIER-MACHINE INTERFACE
SOP	STANDING OPERATING PROCEDURES
SOUTHCOM	U.S. SOUTHERN COMMAND
SPOD	SEA PORT OF DEBARKATION
SPOE	SEA PORT OF EMBARKATION
SQL	STRUCTURED QUERY LANGUAGE
STACCS	STANDARD THEATER ARMY COMMAND AN CONTROL SYSTEM
STU III	SECURE TELEPHONE UNIT III
SUPCOM	SUPPORT COMMAND
TA	THEATER ARMY
TA/ACC	THEATER ARMY/ARMY COMPONENT COMMAND
TAACOM	THEATER ARMY AREA COMMAND
TAMCA	THEATER ARMY MOVEMENT CONTROL AGENCY
TCC-A	THEATR COMMUNICATIONS COMMAND-ARMY
TCP/IP	TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL
TPFDD	TIME-PHASED FORCE DEPLOYMENT DATA
TRADOC	U.S. ARMY TRAINING AND DOCTRINE COMMAND
TRANSCOM	TRANSPORTATION COMMAND
TRI-TAC	TRI-SERVICES TACTICAL COMMUNICATIONS PROGRAM
TUSA	THIRD U.S. ARMY
USAREUR	U.S. ARMY EUROPE
USARJ	U.S. ARMY JAPAN
USARPAC	U.S. ARMY PACIFIC
USARSO	U.S. ARMY FORCES SOUTHERN COMMAND
USMTF	UNITED STATES MESSAGE TEST FORMAT
UTACCS	USAREUR TACTICAL AUTOMATED COMMAND AND CONTROL SYSTEM
WAN	WIDE AREA NETWORK
WWMCCS	WORLDWIDE MILITARY COMMAND AND CONTROL SYSTEM

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